

To : _____

Specification of FUJITSU TFT-LCD module

FLC38XGC6V-04

-old pt #

NA19020-C053

new pt #

Approval	
Date :	
By :	

Specification No. : Tech Bes 98/27972

Issue Date : May 17, 1999

Issued by :



T. Naka

Director
LCD Design Dep.
LCD Technology Div.
LCD Group

FUJITSU LIMITED

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[FLC38XGC6V-04]							
Revision history							
Revision	Date	Prepared	Checked	Approved	Summary		
2 1 H	Aug. 18. 1998	T. Minemura	T. Minemura	T. Naka	Characteristic improvement		
2 2 H	May 17. 1999	M. Miyahara	T. Minemura	T. Naka	Design Change of LCD driver		
2 3 I	May 17. 1999	M. Miyahara	T. Minemura	T. Naka	Design Change of timing IC		

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780818	11/11/98	T. Minemura		Change p1. 22~24		

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[FLC38XGC6V-04]

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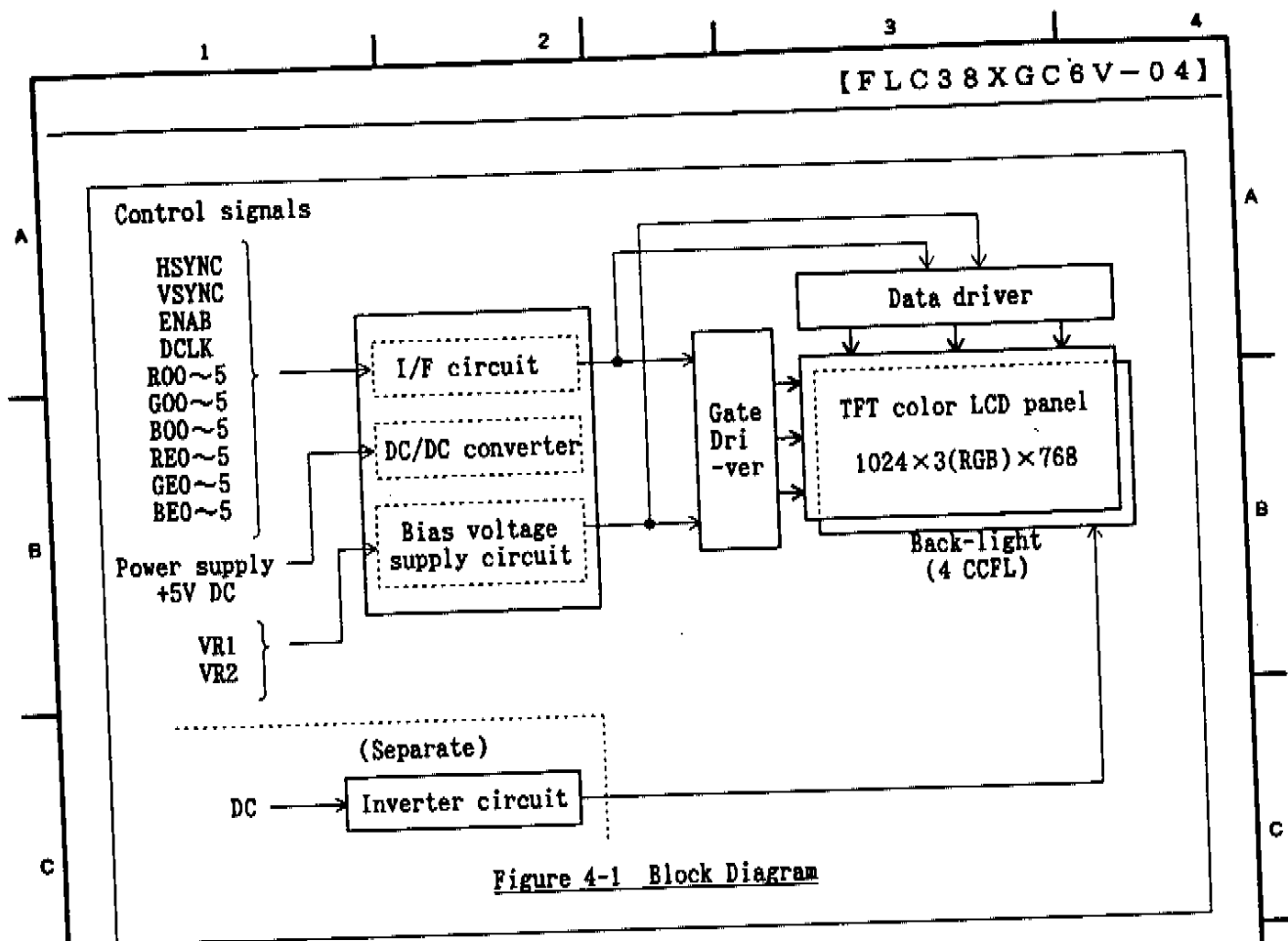
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		[FLC38XGC6V-04]			
A	1. APPLICATIONS				
	This specification is applied to the 15.0 in. XGA supported TFT-LCD module.				
B	2. PRODUCT NAME AND MODEL NUMBER				
	2-1 Product Name : LCD Module				
	2-2 Model Number : FLC38XGC6V-04				
C	3. OVERVIEW				
	This LCD module has a TFT active matrix type liquid crystal panel 1024x768 pixels, and diagonal size of 38cm(15.0-inch). This module supports 1024x768 XGA mode(Non-interlace). This LCD has a digital RGB interface and can display 262,144 colors.				
	In addition to "Horizontal synchronize signal:Hsync" and "Vertical synchronize signal:Vsync", this module can be controled by "Data enable signal:ENAB", which is able to control video signal timing without Hsync and Vsync. (Data enable mode)				
	Even and odd data are transmitted at the same timing in the interface, so data lines are 36.(R,G,B each 6 bit x2) The signal level of this interface is +3.3V CMOS level or 5V TTL level.				
D	The power supply of this LCD module is +5V DC single.				
	This module has the characteristics for applying TCO' 95.				
	4. CONFIGURATION				
E	This LCD module consists of a color TFT-LCD panel that is mounted with TFT driver ICs, a cold-cathode fluorescent tube back-light, and a RGB digital interface board. The inverter for the back-light is not included.				
	Figure 4-1 shows a block diagram of this LCD module.				
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5. MECHANICAL SPECIFICATIONS

Table 5-1 shows the mechanical specifications of this LCD module.

Table 5-1 Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	347.3 × 263.5 × 16.5 (TYP) (Excluding I/F Connector and fixing parts)	mm	Edge type back-light is used. ($\phi 2.6$ CCFL×4)
Display Resolution	(1024 × 3) × 768	—	Without a inverter.
Display Dot Area	304.1 × 228.1	mm	For details on dimensions, see Dimensional Outline Drawing. (at page 29,30)
Dot Pitch	(0.099×3)×0.297	mm	
Aspect Ratio	1 : 1	—	
Weight	1,900 max	g	Excluding inverter.
FG-SG	short circuit	—	—

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6. ABSOLUTE MAXIMUM RATING

Table 6-1 shows the absolute maximum rating of this LCD module.

Table 6-1 Absolute Maximum Rating

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Supply Voltage	V _{CC}	Ta=25°C	-0.3	—	6.0	V
Input Voltage	V _{IN}	Ta=25°C	-0.3	—	V _{CC} +0.3	V

7. ELECTRICAL SPECIFICATIONS

Table 7-1 shows the recommended operating conditions of this LCD module.

Table 7-1 Recommended Operating Conditions

Item		Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage (Logic)		V _{CC}	4.75	5.0	5.25	V
Ripple Voltage	V _{CC}	V _{RP}	—	—	100	mV

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8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications of this LCD module. Figure 8-1 shows the measurement circuit. Figure 8-2(A) shows the equivalent circuit of the logic signal input area. Figure 8-2(B) shows the equivalent circuit of the supply voltage input area.

Table 8-1 Electrical Specifications

Table 6-1 Electrical Specifications								
Item		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remark
Supply Current ②		I _{cc}	V _{CC} = +5.0±0.25V V _{SS} =0V DCLK=32.505MHz	—	320	700	mA	*1
"H" Level Logic Input Voltage		V _{IH}		2.3	—	V _{CC}	V	
"L" Level Logic Input Voltage		V _{IL}		V _{SS}	—	0.9	V	
④Leak Current(Logic Input)		I _{IL}		-5	—	+5	μA	
Supply Rush Current ②		I _{scc}		—	—	5.5	A	*2
Supply Rush Current Duration(1A excess) ②		T _{scc}		—	—	0.4	ms	
Contrast Regulation VR		R _{VR}		0	—	100	kΩ	
B A C K L I G H T *4	CCFL Turn on Voltage ②	V _s	f _L =50kHz, Ta=25℃	—	1324	1500	V _{rms}	
			f _L =50kHz, Ta=0℃	—	—	1500		
	Lighting Voltage ②	V _L	f _L =50kHz I _L = 7mA	550	580	610	V _{rms}	
	Lighting Frequency	f _L	V _L =580Vrms	40	50	60	kHz	
	Tube Current ②	I _L	f _L =50kHz V _L =580Vrms	6	7	8	mA	*4

- ②(*1) Typical current situation: Color bar pattern. $V_{cc}=5.0V$
Maximum current situation: 2-pixel checker pattern. $V_{cc}=4.75V$
Without rush current.
- (*2) These items prescribe the rush current for starting internal DC/DC.
Charging current to capacitors of V_{cc} is not prescribed.
- ②(*3) Back-light specifications are valid when using a suitable inverter such as the "HIU-390" (PLCV-06) of HARISON ELECTRIC CO., LTD.
- (*4) Tube Current (I_L) shows the value of the current that is consumed at one lamp.
④ This LCD module has 4 lamps. Each 2 lamps are placed at upper side and lower side of the display. 2 lamps is connected in parallel. Each low voltage terminals are connected with 1 line cable to Back-light connector.

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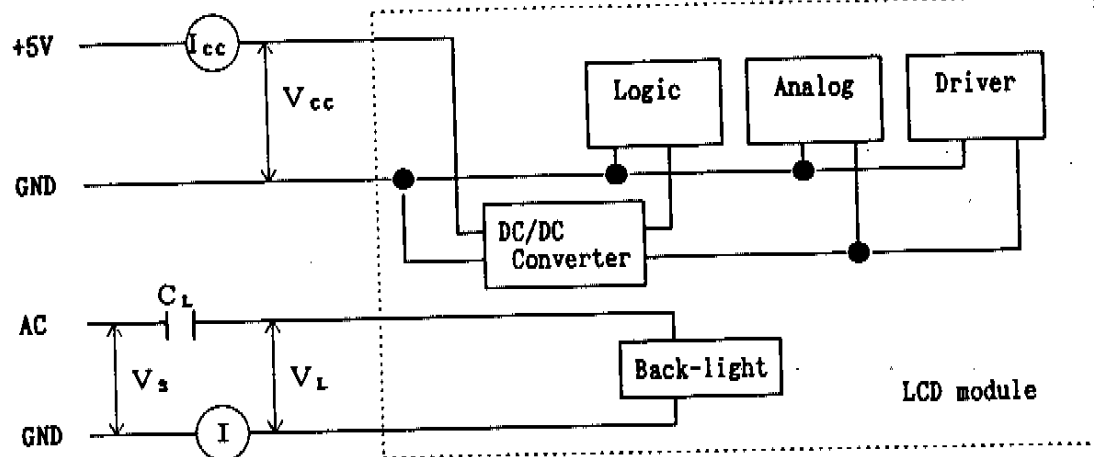
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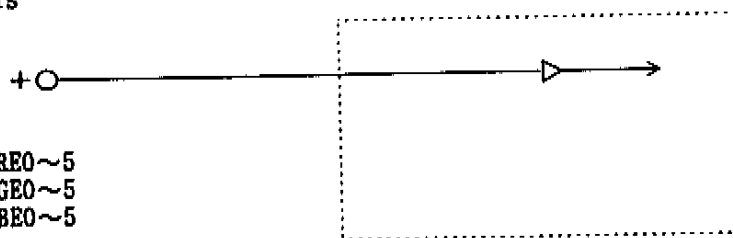
Measurement circuit is based on Figure 8-1.



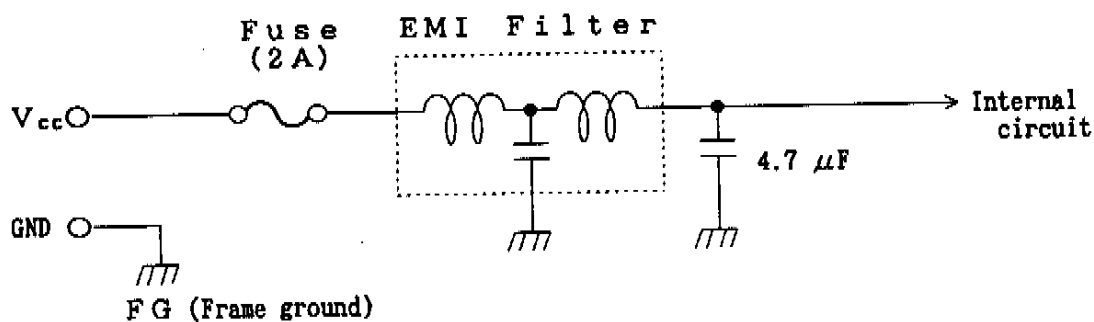
② Figure 8-1 Measurement circuit

Input signals

HSYNC
VSYNC
ENAB
DCLK
R00~5, RE0~5
G00~5, GE0~5
B00~5, BE0~5



② Figure 8-2(A) Equivalent circuit of logic signal input



Fuse F0805B2R00FWTR (KYOCERA CORPORATION)
EMI Filter ... KNH21104 (KYOCERA CORPORATION)

② Figure 8-2(B) Equivalent circuit of power supply

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9. OPTICAL SPECIFICATIONS

Table 9-1 shows the optical specifications of this LCD Module.
 Table 9-1 Optical Specifications

Ta=25℃

Table 9-1 Optical Specifications											
Item		Symbol	Condition		Specifications			Unit	Remark		
					MIN.	TYP.	MAX.		Note		
Visual Angle ②	Horizontal	$\theta_{L,R}$	CR \geq 10	$\theta_{U,D}=0^{\circ}$	80	—	—	deg		(1)(2) (3)(5) (6)	
	Vertical	$\theta_{U,D}$		$\theta_{L,R}=0^{\circ}$	80	—	—	deg			
Contrast Ratio ②		④ CR	$\theta_{L,R}$ $\theta_{U,D}=0^{\circ}$	(R _{VR} =100k)	210	300	—	—	White/ Black	(1)(2) (3)(5)	
				(R _{VR} =100k)	190	270	—				
Response Time (B→W) (ON)		t _{on}	$\theta_{L,R}$ $\theta_{U,D}=0^{\circ}$	Ta=25℃	—	15	30	ms		(1) (4) (5)	
				Ta= 0℃	—	50	100	ms			
Response Time (W→B) (OFF)		t _{off}	$\theta_{L,R}$ $\theta_{U,D}=0^{\circ}$	Ta=25℃	—	10	25	ms			
				Ta= 0℃	—	50	100	ms			
Brightness ②		I	$\theta_{L,R,U,D}=0^{\circ}$ V _{CC} =5V, I _L =7mA (@ Maximum Brightness)			200	250	—	cd/m ²	White *1	(1)(5)
Brightness Uniformity		ΔI				80	—	—	%		(1)(5) (7)
Chromaticity	W	x				0.283	0.313	0.343	—		(1) (5)
		y				0.299	0.329	0.359	—		
④ R G B		(x,y)	Red Green White	(0.600, 0.342) Typ. (0.295, 0.571) Typ. (0.148, 0.112) Typ.							
LCD Panel Type					TFT Color						
Display Mode					Normaly Black VA						
Wide Viewing Angle Technology					MVA						
Optimum Viewing Angle					— (symmetry)						(6)
Display Color					262,144 (6-bit color)						
Color of non-display area					Black						
Surface Treatment					Anti-glare(Haze value:30%,2H(at 300gf load)						

(*1) Value at 15~20 minutes after lighting on.

(Note) · CS-1000(MINOLTA Co.,Ltd.), BM-5A(Topcon) and the like should be used as a luminance colorimeter. Field=2°, L=500mm

④ · Back-light current = 7mA, R_{VR}=100k, Dark room condition (1 lux or less)④ · Omitting R_{VR} is possible. In that case, CR value is nearly equal at R_{VR}=100k.

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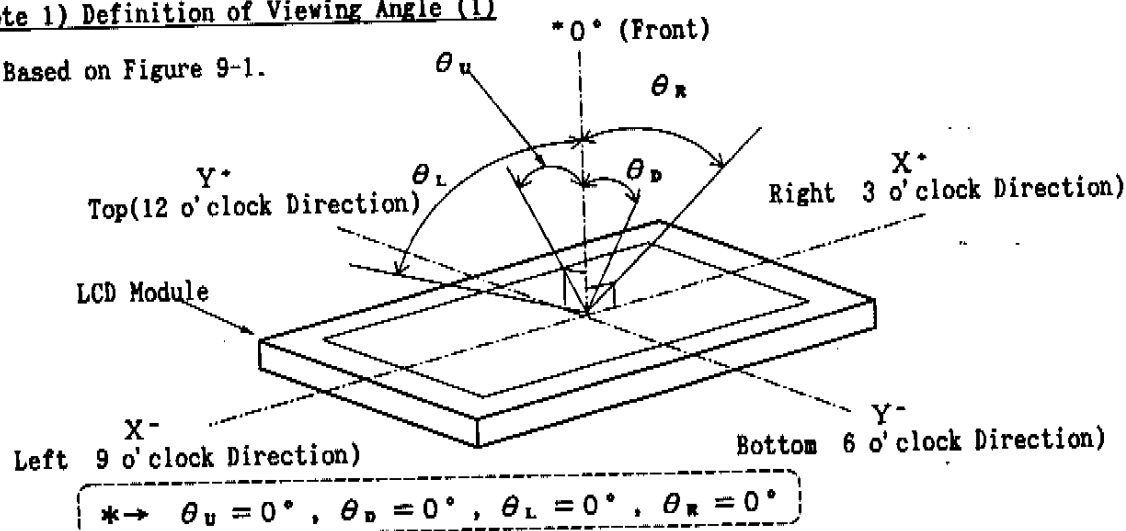
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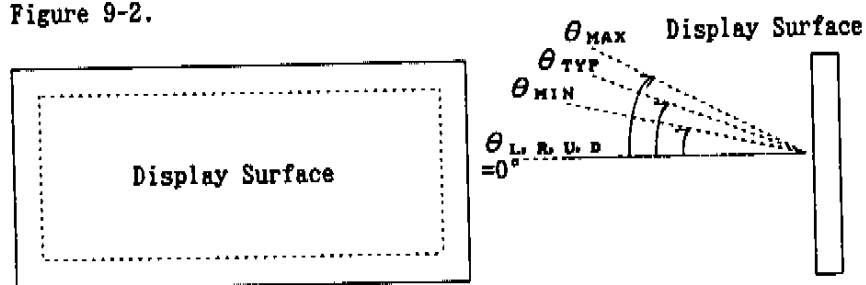
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Note 1) Definition of Viewing Angle (1)

Based on Figure 9-1.

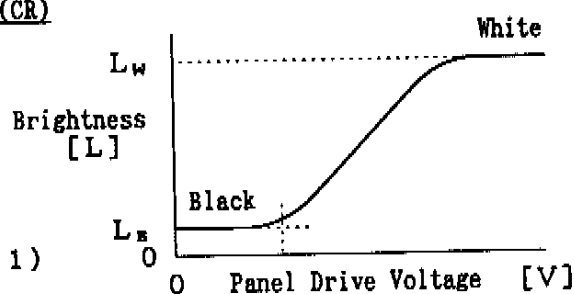
Figure 9-1 Definition of Viewing Angle (1)Note 2) Definition of Viewing Angle (2)

Based on Figure 9-2.

Figure 9-2 Definition of Viewing Angle (2)Note 3) Definition of Contrast Ratio(CR)

Determined by Formula(1) based on Figure 9-3 Voltage-Brightness Characteristics

$$= \frac{L_w \text{ (Brightness at white)}}{L_b \text{ (Brightness at black)}} \dots (1)$$

Figure 9-3 Voltage-Brightness Characteristics

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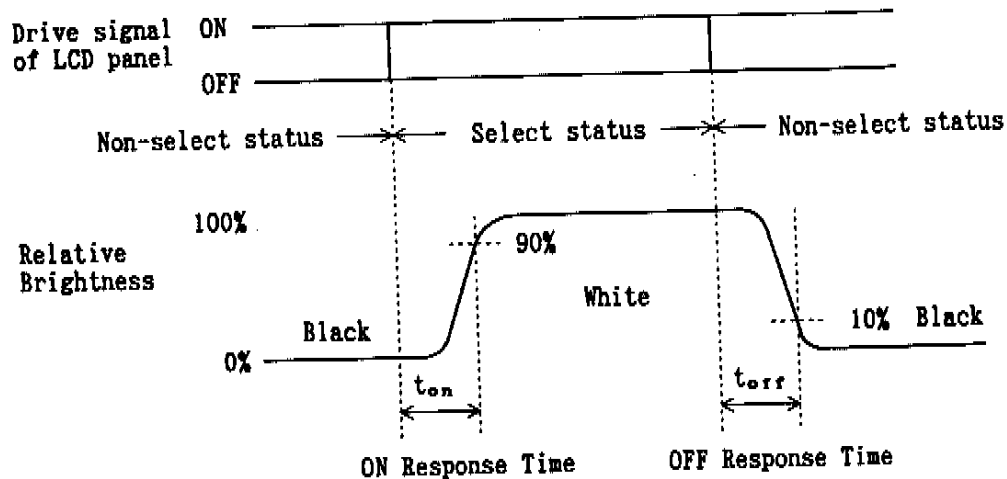
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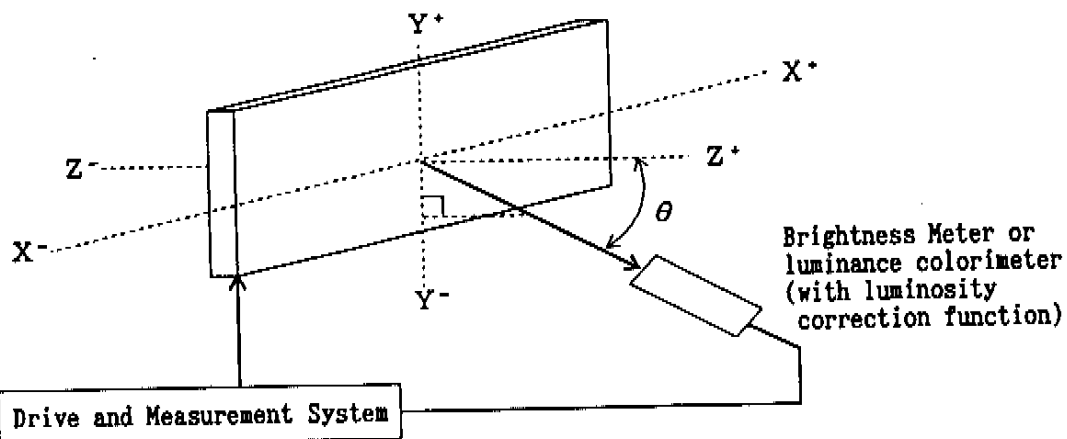
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Note 4) Definition of Response Time

Based on Figure 9-4.

**Figure 9-4 Definition of Response Time****Note 5) Contrast Ratio and Response Measurement System**

Based on Figure 9-5.

**Figure 9-5 Contrast Ratio and Response Time Measurement System**

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Note 6) Definition of Optimum Viewing Angle

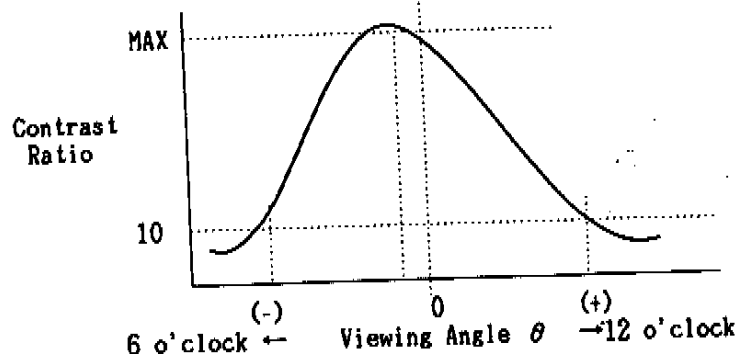
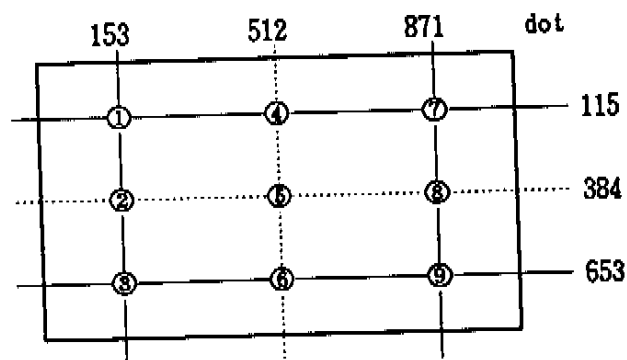


Figure 9-6 Definition of Optimum Viewing Angle

Note 7) Definition of Brightness Uniformity

Brightness uniformity is defined by the following formula.
Brightness (11~19) are measured at the following 9 points (①~⑨) on the display area that is shown in Figure 9-7.

$$\text{Brightness Uniformity}(\Delta L) = \frac{|\text{Min. In}|}{|\text{Max. In}|} \times 100 (\%), \quad n=1 \text{ to } 9$$



Note) Each measurement point (①~⑨) defines the center spot of view of Brightness Meter. The tolerance of measurement position is ± 5 mm. ④

Figure 9-7 Measurement Points

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10. INTERFACE SPECIFICATIONS

10-1 Signal descriptions

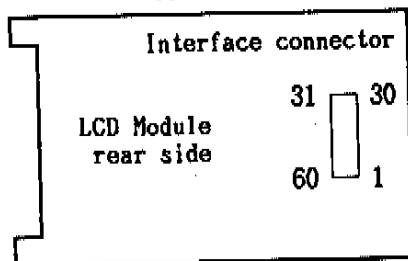
Table 10-1 shows the description and configuration of interface signals(CN1).

Table 10-1 Interface signals(CN3)

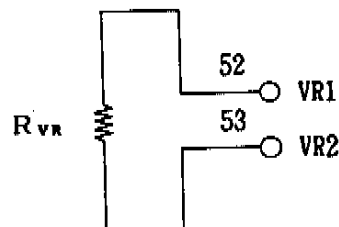
Pin No.	Symbol	I/O	Function	Pin No.	Symbol	I/O	Function
1	GND	-	Ground	31	G01	I	Green odd data 1
2	RE0	I	Red even data 0	32	G02	I	Green odd data 2
3	RE1	I	Red even data 1	33	G03	I	Green odd data 3
4	RE2	I	Red even data 2	34	G04	I	Green odd data 4
5	RE3	I	Red even data 3	35	G05	I	Green odd data 5
6	RE4	I	Red even data 4	36	GND	-	Ground
7	RE5	I	Red even data 5	37	B00	I	Blue odd data 0
8	GND	-	Ground	38	B01	I	Blue odd data 1
9	GE0	I	Green even data 0	39	B02	I	Blue odd data 2
10	GE1	I	Green even data 1	40	B03	I	Blue odd data 3
11	GE2	I	Green even data 2	41	B04	I	Blue odd data 4
12	GE3	I	Green even data 3	42	B05	I	Blue odd data 5
13	GE4	I	Green even data 4	43	GND	-	Ground
14	GE5	I	Green even data 5	44	VSNC	I	Vertical Synchronizing signal
15	GND	-	Ground	45	HSNC	I	Horizontal Synchronizing signal
16	BE0	I	Blue even data 0	46	ENAB	I	Data enable signal
17	BE1	I	Blue even data 1	47	GND	-	Ground
18	BE2	I	Blue even data 2	48	GND	-	Ground
19	BE3	I	Blue even data 3	49	DCLK	I	Dot clock signal
20	BE4	I	Blue even data 4	50	GND	-	Ground
21	BE5	I	Blue even data 5	51	GND	-	Ground
22	GND	-	Ground	52	VR1	-	Contrast regulating VR1
23	RO0	I	Red odd data 0	53	VR2	-	Contrast regulating VR2
24	RO1	I	Red odd data 1	54	GND	-	Ground
25	RO2	I	Red odd data 2	55	GND	-	Ground
26	RO3	I	Red odd data 3	56	GND	-	Ground
27	RO4	I	Red odd data 4	57	VDD	-	+5v Power supply
28	RO5	I	Red odd data 5	58	VDD	-	+5v Power supply
29	GND	-	Ground	59	VDD	-	+5v Power supply
30	G00	I	Green odd data 0	60	VDD	-	+5v Power supply

Connector : 52760-0600(Molex) User's connector : 53475-0600(Molex)

Upper side

Contrast regulating VR: R_{VR} (100k Ω)

Lower side



④ Omitting R_{VR} is possible.
In this case, CR value is nearly equal
at $R_{VR} = 100k\Omega$.

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10-2 Color Data Assignment

Table 10-2 shows the Color Data Assignment.

Table 10-2 Color Data Assignment

Color		R input data						G input data						B input data					
	Odd Even	R05	R04	R03	R02	R01	R00	G05	G04	G03	G02	G01	G00	B05	B04	B03	B02	B01	B00
		RE5	RE4	RE3	RE2	RE1	RE0	GE5	GE4	GE3	GE2	GE1	GE0	BE5	BE4	BE3	BE2	BE1	BE0
Basic color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Red	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	brighter	61	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↓	62	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Red	63	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	brighter	61	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
	↓	62	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
Blue	Green	63	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	brighter	61	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	↓	62	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	63	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note.1) Definition of gray scale: Color(n)..... n indicates gray scale level.
Larger number n means brighter level.

Note.2) Data; 1:High, 0:Low

Note.3) Color data consist of 6 bit red, green and blue data of odd and even number pixel data. Total data number is 36 signals. this module is able to display 262,144 colors because each red, green and blue data is controlled independently.

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10-3 Input Signal Timing

Table 10-3 and Figure 10-2 shows the Input Signal Timing.

(T=0~50℃, V_{cc}=5±0.25V)

Table 10-3 Timing Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK signal (Clock)	Period	Tc	④25.000	30.764	40.000	ns	
	Frequency	1/Tc	25.000	32.505	40.000	MHz	
	Duty	Tch/Tc	40	50	60	%	
	④ High time	Tclkh	5.0	—	—	ns	
	④ Low time	Tclkl	5.0	—	—	ns	
	④ Rise time	Tclkr	—	—	5.0	ns	
	④ fall time	Tclkf	—	—	5.0	ns	
DCLK-Data timing	Set up time	Tset	4.5	—	—	ns	40MHz
	Hold time	Thold	6.5	—	—	ns	40MHz
Hsync signal ③	Period	Th1	660*2	672	1566 **	DCLK	ENAB Invalid
	Period	Th2	565*2	672	1566 **	DCLK	ENAB Valid
	Frequency	1/Th	—	48	60	kHz	
	Pulse width	Thp	2**	68	—	DCLK	*1.2
	Back-porch	Thb	0	80	Th-Thp-512	DCLK	*1.2
	Display period	Thd	—	512	—	DCLK	*3
	Front-porch	Thf	—	12	—	DCLK	*1.2
Vsync signal	Period	Tv	772*2	806	868 **	Th	16.67 ms
	Frequency	1/Tv	—	③60	③ 75	Hz	
	Pulse width	Tvp	4**	6	—	Th	*1.2
	Back-porch	Tvb	0	29	Tv-Tvp-768	Th	*1.2
	Display period	Tvd	—	768	—	Th	*3
	Front-porch	Tvf	—	3	—	Th	*1.2
	Hsync-Vsync timing	Tvh	1	Thp	Th-Thp	DCLK	
ENAB signal	Hsync-ENAB timing	—	—	—	—	DCLK	*1
	Data-ENAB timing	Tdn	—	0	—	DCLK	*4

- *1) When ENAB(Data Enable Signal) is valid, horizontal display position is specified by the rise of ENAB. The data latched at falling edge of DCLK after rise of ENAB is displayed at the left edge of the display area.
- Vertical display position is specified by the rise of ENAB after low level continuation or 4 Hsync period. The data latched at the rise of ENAB is displayed at the top line of the display area.
- ※ When ENAB alternates between "High" and "Low" level with valid period, "Data enable mode" is available. In this mode, Hsync and Vsync is completely ignored, and ENAB makes display position fit to the display area.
- *2) When ENAB signal stays "Low" or "High" level, the data latched at the 149 (Thp+Thb+1)-th falling edge of DCLK after falling of Hsync is fixedly displayed at the left edge of the display area for horizontal direction.
- For vertical direction, the data latched in the 36(Tvp+Tvb+1)-th "High" level period of Hsync after falling of Vsync is displayed at the top line of the of the display area.
- *3) If the "High" level period of ENAB is less than 512 DCLK or the number of ENAB in a frame period(Tv) is less than 768, black color is displayed at the rest of the display area.
- *4) If ENAB does not synchronize with the effective display data, the display position does not fit to the display area.

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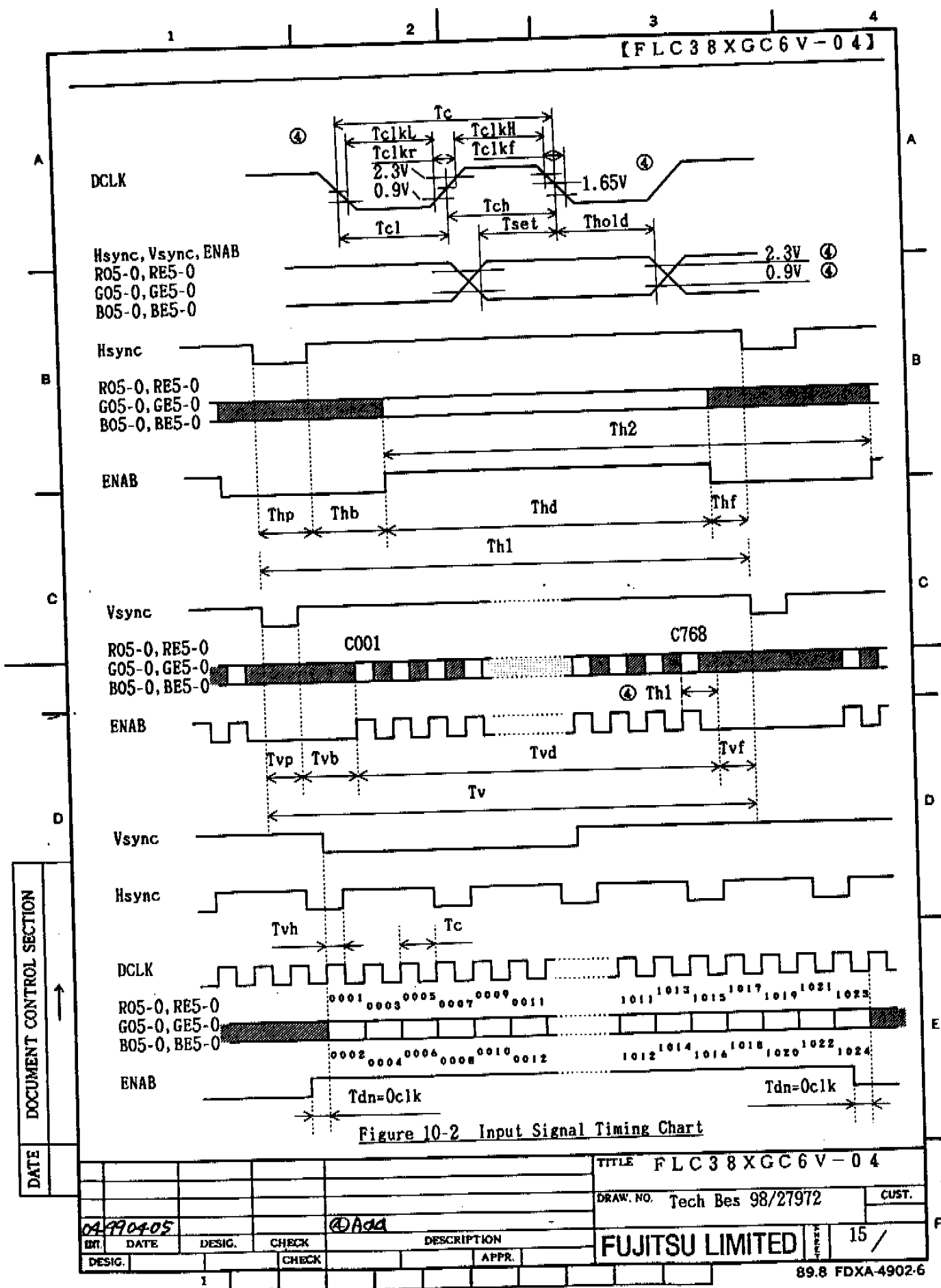
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10-4 Correspondence between Data and Display Position

Figure 10-3 shows the Correspondence between Data and Display Position.

	S0001	S0002	S0003	S0004	S0005	S0006	S0007	S0008	-----	S3071	S3072
C001	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1024	BE 1024
C768	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1024	BE 1024

Figure 10-3 Correspondence Data and Display Position

10-5 Power Supply Sequence

The sequence of input signals and On/Off of the power supply of this LCD modul should be in the specification shown in Figure 10-4 to prevent Latch-up of the driver ICs and DC driving of the LCD panel.

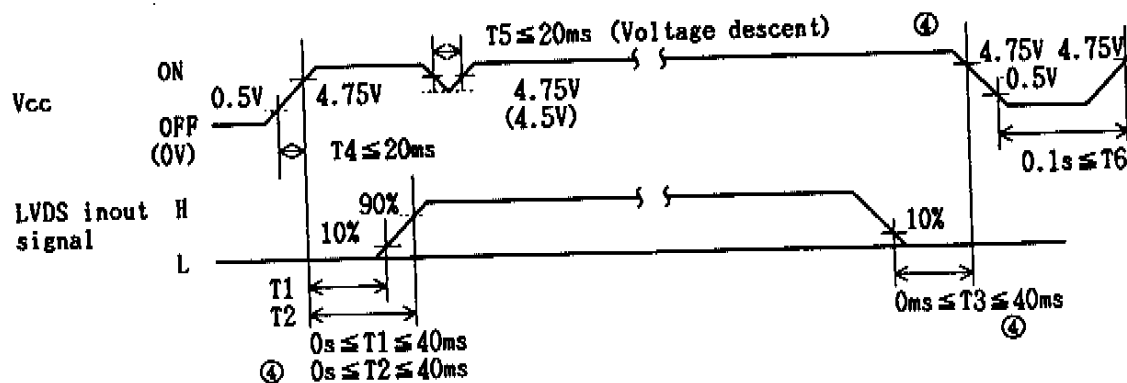


Figure 10-4 Power Supply Sequence

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11. BACK-LIGHT SPECIFICATIONS

11-1 Pin configuration for Back-light

Table 11-1 and 11-2 show the description and Pin assignment of the connectors (CN-A and B) for the backlight of this LCD module.

Table 11-1 Pin Assignment of CN-A

Pin No.	Signal	Function
1	GND	Ground (for V_L 1,2)
2	NC	---
3	NC	---
4	NC	---
5	V_L 1	Power supply for CCFL1
6	NC	---
7	V_L 2	Power supply for CCFL2

Table 11-2 Pin Assignment of CN-B

Pin No.	Signal	Function
1	GND	Ground (for V_L 3,4)
2	NC	---
3	NC	---
4	NC	---
5	V_L 1	Power supply for CCFL3
6	NC	---
7	V_L 2	Power supply for CCFL4

Cable color (CN-A and B): White at GND, Pink at V_L 1,2,3 and 4

Connector: Housing : XHP-7
Contact : SXH-002T-P0.6
User's Connector: Post with base: B7B-XH-A (Top type) or
S7B-XH-A (Side type)
Supplier: Japan Solderless Terminal Trading Company LTD. (-J.S.T.)

11-2 CCFL

Supplier: KOWA ELECTRIC CO., LTD Part No.3301-154-0

11-3 Life

The life of the back-light is a minimum of 25,000 hours at the following conditions.

(1) Working conditions

- ① Ambient temperature : $25 \pm 5^\circ\text{C}$
- ② Tube current (I_L) : (7mA or less)

(2) Definition of life

- ① Brightness becomes 50% or less than the minimum brightness value shown in Table 9-1.
- ② The lamp cannot be lit by the minimum value of the breakdown voltage (1500 Vrms) shown in Table 8-1.
- ③ Flashing

④ 11-4 Lamp Assembly set (for replacement)

Lamp Assembly set (with charge) is prepared for replacing old lamp to new one. This set consists of a upper lamp assembly and a lower lamp assembly.

Type number: FLCL-13S (for upper and lower)

Notes) Type number of a upper lamp assembly is FLCL-10.
Type number of a lower lamp assembly is FLCL-11.

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12. APPEARANCE SPECIFICATIONS

Length: L [mm]

Width: W [mm]

Average diameter: D [mm]

12-1 Appearance

No.	Item		Judgement method and standard		Remarks
1	Foreign Particle	Black particle	$0.5 > D$	$N \leq 4$	Recognized in the cell with lighting
		fiber	$3.0 > L$	$N \leq 4$	
2	Scratch	Scratch on polarizer film	$10.0 > L$	$N \leq 6$	
3	Nick	Nick on polarizer film	$0.5 > D$	$N \leq 6$	

Note

- Foreign particle and scratch that do not affect display image, such as foreign particle between glass and polarizer film out of the display area, scratch on metal vessel, back-light module or polarizer film out of the display area, etc. are not counted.
- These items apply to defects in the cell when the backlight is on, and defects on the surface of polarizer film inside the display area.
- Visually inspect appearance with keeping your eyes 35cm or more from the panel, using one 20W fluorescent light illumination at 50cm above the work table. At this time, the illuminance in the vertical direction to the fluorescent light is 400 to 600 lux(reference value).

12-2 Dot defects (Bright spots, Dark spots)

12-2-1 Zone

Inside display dot area (304.1 x 228.1 mm)

Display dot area means active area.

One pixel consists of 3 dots (red, green and blue).

12-2-2 Bright spots

- Bright spots classification (based on brightness samples)
 - Visible with 2% ND filter --- High Bright spot R · G
 - Visible with 5% ND filter
 - but not visible with 2% ND filter --- Low Bright spot R · G · B
 - Not visible with 5% ND filter --- not counted
- Defects of color filter
 - Larger than one half of a dot
 - Same or smaller than one half of a dot
- Defects of chrome mask
 - Larger than $\phi 50\mu\text{m}$ --- High Bright spot
 - Same or smaller than $\phi 50\mu\text{m}$ --- not counted

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12-2-3 Number of luminescent spot standard

Item	Entire Screen	
	High Bright Spots	High and Low Bright Spots
Brightness classification		
Number of defects	9 or less	15 or less

NOTES:

1. Display should be all black when luminescent spot is counted.
2. Number of high Bright spots of green(G) is up to 7.
3. Number of two low Bright spot connections is up to 7.
4. Number of three Bright spot connections and two high Bright spot connections is 0.
5. Number of high Bright spot and a low Bright spot connections is up to 4.

12-2-4 Distance between Bright spots

- High Bright spots R and G ----- 15 mm or more
- High Bright spots and low Bright spot ----- 5 mm or more
(Except one or two of two bright spot connections)

12-2-5 Number of Dark spots standard

Item	Entire Screen	
Number of defects	16 or less (When display is all white)	

NOTES:

1. Display should be all white when dark spot is counted.
2. Number of two dark spot connections is up to 5.
3. Distance between defects is 5 mm or more.
4. If dark spot is smaller than one dot size, convert with following rule and sum up.
 - (a) $A < 1/3$: Not count.
(Only one of 4 dark connection is allowed.)
 - (b) $1/3 \leq A < 2/3$: Considered as 0.5 dot.
 - (c) $2/3 \leq A$: Considered as 1 dot.
(A = Dark spot size/dot size)

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13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 shows the environmental specifications.

Table 13-1 The environmental specifications

Item	Condition		Remark
Temperature	Operation	0 ~ 50 °C	Temperature on surface of LCD panel (display area).
	Storage	- 20 ~ 60 °C	
Humidity	Operation	20 ~ 85 %RH	Maximum wet-bulb temperature should not exceed 29°C. No condensation.
	Storage	5 ~ 85 %RH	
Vibration	Non-operation	10~500Hz, 1 octave / 20 minute, 2G, 1.5mm max. 1 hour each X,Y and Z directions	For single module without package.
Shock	Non-operation	50G, 6ms, 1 times each ② ±X, ±Y and ±Z directions.	

NOTE: Table 13-2 and Figure 13-1 show the shock resistance standard when module is packaged.

Table 13-2 Shock resistance standard when module is packaged

Dropping location	Dropping height	Count
A ~ J	60cm	1 time

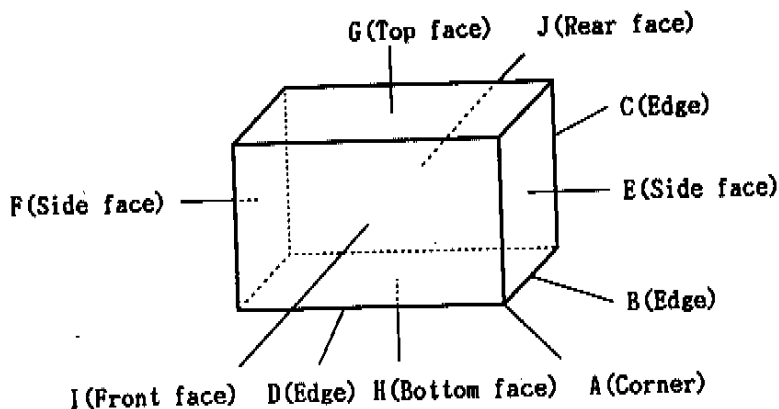


Figure 13-1 Direction to apply shock to package

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[FLC38XGC6V-04]

14. INDICATIONS

This module has the following indications.

- (1) Product name : LCD unit ④
- (2) Model Number : FLC38XGC6V-04
- ② (3) Product Drawing Number : NA19020-C053
- (4) Manufacturing Number : 8 Y 0 0 0 0 1 ②
- Serial number (To be reset every month on 1st.)
- Manufacturing month (Oct.=X, Nov.=Y, Dec.=Z)
- Last digit of manufacturing year
- ② (5) Version number : 21H (Example)
 - 1st 2 digits "21" means operational version.
 - 3rd alphabet means functional version.
- (6) Manufacturer Country Name : MADE IN JAPAN
- (7) Company Name : FUJITSU LIMITED
- (8) Disposal method of cold-cathode tubes. (See Fig.14-1) ④
- (9) Caution when changing cold-cathode tubes. (See Fig. 14-2) ④

・ THIS TFT COLOR LCD CONTAINS COLD CATHODE FLUORESCENT LAMPS. PLEASE FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR ITS DISPOSAL.

・ 液晶ディスプレイユニットには、蛍光管が組み込まれていますので、地方自治体の条例または規程に従って廃棄して下さい。

Fig. 14-1

・ WHEN CHANGING COLD CATHODE FLUORESCENT LAMPS, FOLLOW OPERATING SPECIFICATIONS. ESPECIALLY BE CAREFUL ABOUT THE LAMP'S SIDE-EDGE.

・ 蛍光管の交換は作業仕様書に従って行って下さい。特に蛍光管ホルダ側のエッジに気をつけて下さい。

Fig. 14-2

15. PACKAGING

Separately specified in packaging specifications.

15-1 Packing specifications

- (1) 5 LCD modules / 1 package.
- (2) Weight : approximately 12kg / 1 package.
- (3) Outline dimensions : 371 mm(W) × 423 mm(D) × 439 mm(H)

15-2 Packing method

Figure 15-1,2 show the packing method.

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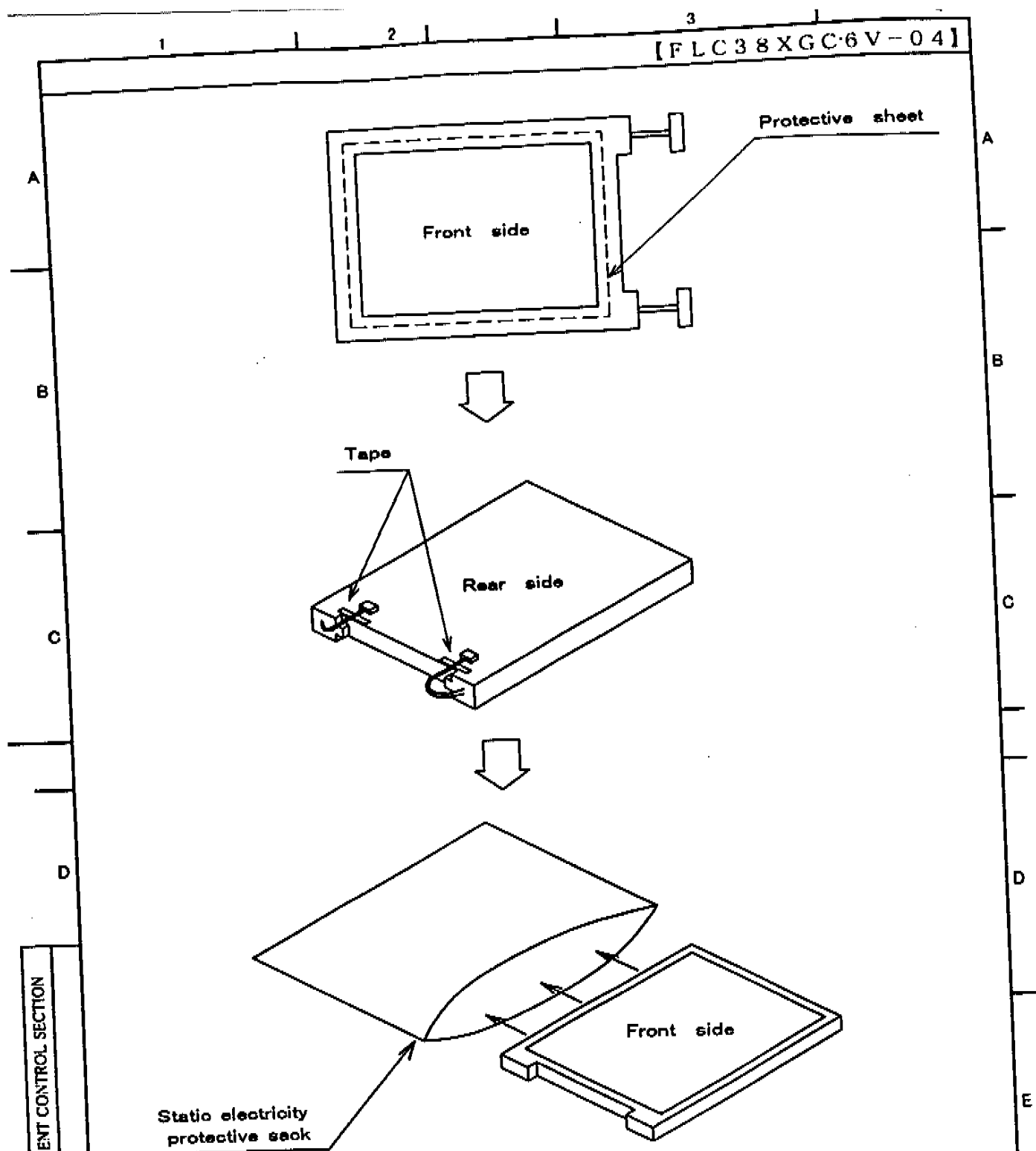


Figure 15-1 Packing method

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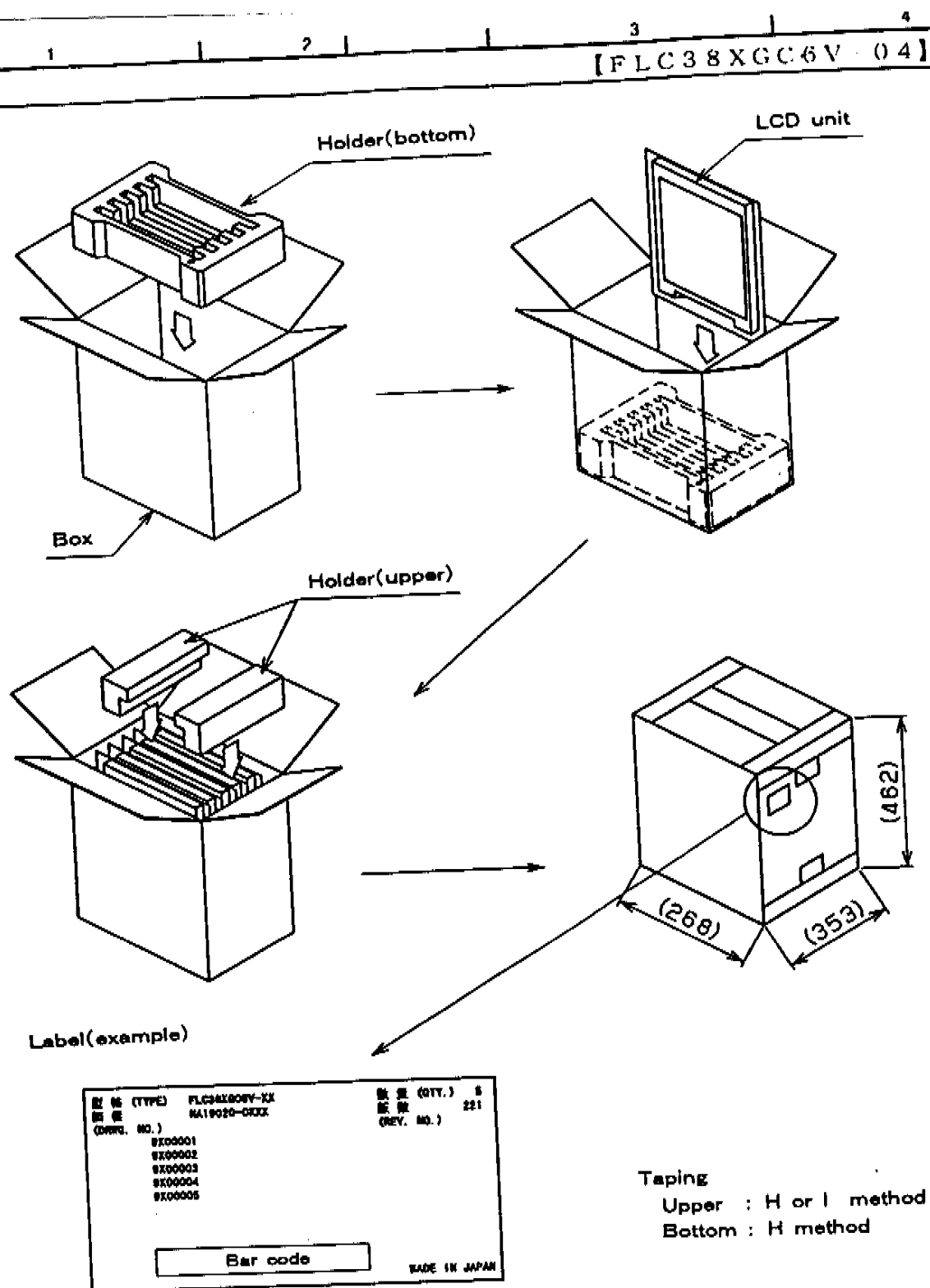


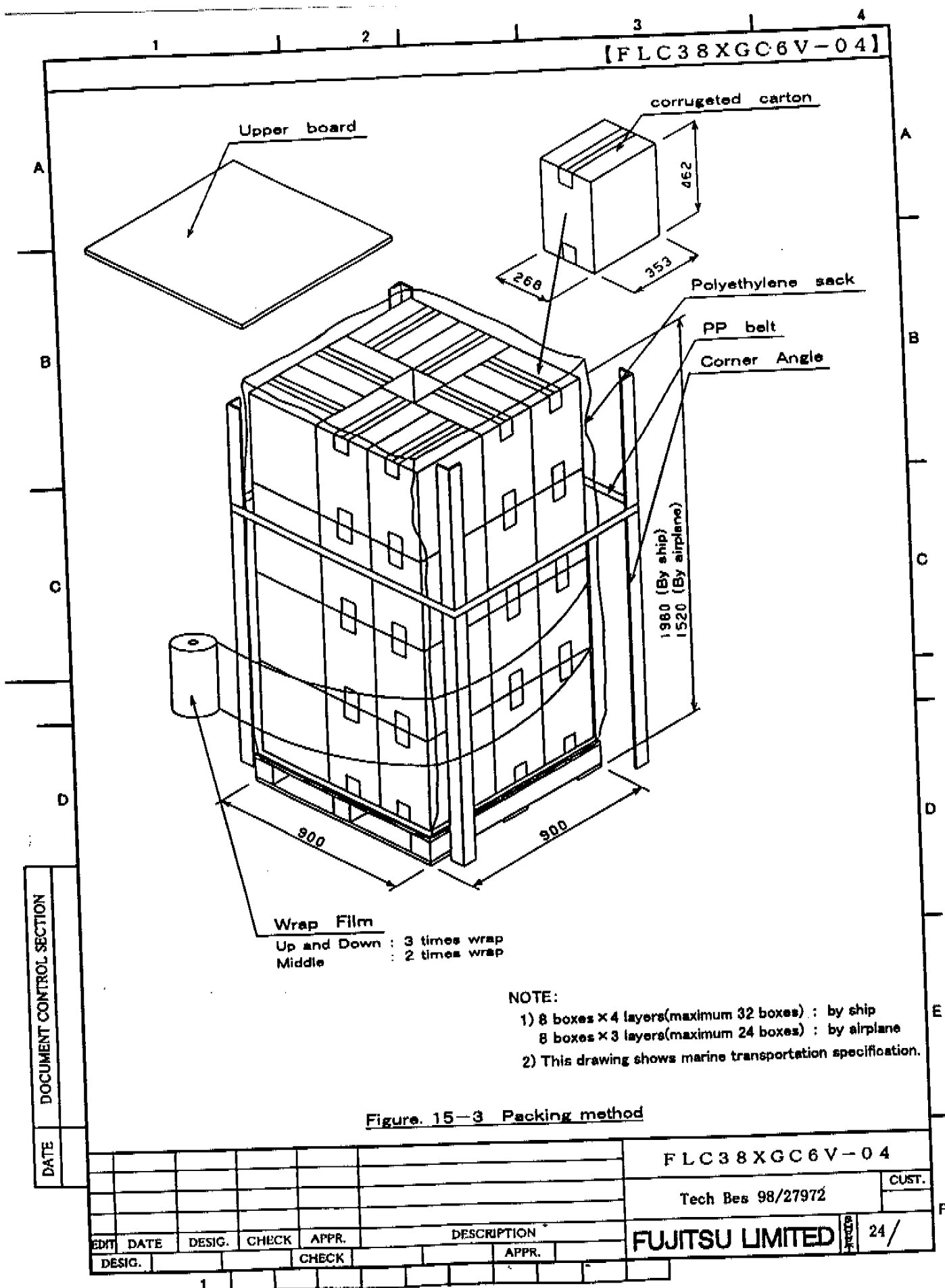
Figure 15-2 Packing method

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[FLC38XGC6V-04]							
A	<p>④ Always input the control signals at the correct timing. If control signals(DCLK, ENAB or DCLK, Hsync,Vsync) are not input, or if the timing is out of the specified timing, the internal circuit automatically generates signals and displays a specified pattern to protect the liquid crystal panel. However, in this status the display does not satisfy the desired display quality. Liquid crystal might be damaged such as memorizing image or contrast decreases by influence of direct current driving.</p>						
B	<p>(5) Precautions on designing module mounting</p> <p>① Do not press the display surface and bottom face of the LCD module. If the display surface is very strongly pressed due to the module mounting design, the desired display quality and reliability may not be assured. If the back-light base is pressed due to the module mounting design, brightness uniformity and the reliability of the cold-cathode tube may not be assured.</p> <p>② Consider the module mounting design, so that twisting and bending do not occur to the LCD module. Outstanding twisting and bending may damage display quality and reliability.</p> <p>③ The power cable length between the LCD module and inverter should not be extended. Otherwise the back-light may not light or flickering may occur.</p> <p>④ Do not make the power cable of the backlight clung to a metal plate, etc. High frequency current for the back-light may leak to the metal plate, and the desired brightness may not be assured.</p> <p>⑤ When Mounting LCD module with M4 screw (x4) should be screw up under 4.5kgf torque.</p>						
C							
D	<p>(6) Storage method</p> <p>① Do not store the LCD module in an atmosphere of organic solvent or corrosive gas. In an organic solvent atmosphere, the polariser film discolours and display quality deteriorates. In a corrosive gas environment, various problems may occur.</p> <p>② Store the LCD module in a Fujitsu package. At storing, Fujitsu packages can be stacked to a maximum of 4. The LCD module is in an anti-static bag. Keep the module in that status.</p> <p>③ It is recommended that the storage environment should be humidity controlled, cool and dark.</p> <p style="margin-left: 40px;">Recommended storage environment</p> <ul style="list-style-type: none"> · Place : Dark(avoid direct sunlight) · Temperature : 10~35℃ · Humidity : 50~60%RH <p style="margin-left: 40px;">Note) If the module is left in an environment of 60 ℃ or more for a long period of time, optical characteristics may deteriorate.</p>						
E							
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<p>18. OTHERS</p> <p>! ① If the LCD panel is damaged, do not inhale or allow the liquid crystal to enter the mouth If the liquid crystal contacts the body or cloth, immediately wash it off with soap. Follow precautions for regular electronic components.</p> <p>② It is no problem that solder flux can remains on a printed circuit board of the LCD module Fujitsu is practicing a non-wash technology for the module assembly process.</p>	
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